

ACTIVITY OF *CULEX*  
*QUINQUEFASCIATUS* IN AN  
UNDERGROUND STORM DRAIN IN SAN  
ANTONIO, TEXAS<sup>1</sup>

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Published information on *Culex quinquefasciatus* Say repeatedly affirms that this species responds directly to cool temperatures by extending the length of its life cycle, rather than by interrupting development with a true state of diapause (Eldridge 1966, 1968; Wilton and Smith 1985). Observations of winter activity in populations of *Cx. quinquefasciatus* in Texas (Hayes and Hsi 1975, Strickman 1983) corroborate the belief that this mosquito can resume activity any time the weather warms sufficiently. With this background, we suspected that a protected site might harbor either concentrations of inactive mosquitoes or a confined population of active adults.

We chose a study site in southeastern San Antonio, where populations of *Cx. quinquefasciatus* were known to be high. The site is a large square (4 × 4 m) storm drain (designated City Project Number 55) which opens into the San Antonio River. Culverts without catch basins enter the drain under most street intersections. Most of the time, water flowed in a shallow (2 to 6 cm) sheet along the floor of the drain with only a few small pools formed on the cement floor.

Adult mosquitoes in the drain were sampled with a battery-operated light trap (Driggers et al. 1980). The trap was hung 2 m above the

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floor of the drain at a point 1020 m from the San Antonio River (directly below the 300 block of Mt. Vernon Street). Weekly, 24-hour samples were collected from November 8, 1983 to April 12, 1985, except when heavy rains or other conditions made entry dangerous. Adults were identified to species, and categorized as male, gravid female or nongravid female. Determination of gravidity was based on dissection of every female. Those with terminal follicles approximately the size and shape of mature eggs (stage IVb or V of Clements 1963) were considered gravid. None of the 1,563 females captured during the study contained accumulations of fat body typical of overwintering *Cx. pipiens* Linnaeus.

Although variable, the data suggest several trends in the population of *Cx. quinquefasciatus* (Table 1). First, gravid females were the first mosquitoes captured in the spring of both 1984 and 1985. Second, males were present in low numbers during much of the year. Finally, catches of female mosquitoes in the storm drain were greatest during times of moderate temperatures. On the basis of monthly means in Table 1, greatest activity was observed (November 1983; April, May, and November 1984) when underground temperatures were between 20° and 23°C and minimum temperatures above ground were between 10° and 18°C. Numbers of trapped females declined during warmer months (June–October 1984)

when underground temperatures were between 23° and 28°C and minimum temperatures above ground were between 18° and 24°C. Adult activity was nearly absent in January and February of both years, though temperatures in the storm drain never declined below freezing. Figure 1 illustrates the level of female activity in relation to temperature for each observation of the study. The highest trap catches are clustered in the middle of the graph, representing times of moderate temperatures both above and below ground.

Weekly, non-quantitative examinations of the storm drain for the presence of larvae were initiated on December 29, 1983. Larvae of *Cx. quinquefasciatus* were found anywhere in the water of the drain (including flowing along with the current), but were most abundant adjacent to the edge of the floor or in pools, where slower flow allowed the larvae to be stationary. Larvae were present on the following dates: December 29, 1983; January 4; April 3, 18, 24, May 1; June 13; and July 5, 1984. With the exception of the June 13 observation, the presence of larvae corresponded to periods of low rainfall (less than 11 mm in a month) when a number of days passed without flushing of the drain by rainwater.

The local population of *Cx. quinquefasciatus* used the storm drain in a number of ways. Although only an occasional occurrence, larvae developed in the site when rains failed to flush

Table 1. Adult *Culex quinquefasciatus* collected in an Army Miniature Light Trap operated 24 hours once per week in an underground storm drain between November 8, 1983 and April 12, 1985, San Antonio, Texas.

Month	Number of observations	Mean number ( $\pm$ S.D.) of mosquitoes				Mean ( $\pm$ S.D.) temperature ( $^{\circ}$ C)		Total ppt. (mm)
		Females			Males	At the site	Min. on night of collection	
		Gravid	Non-gravid	Total				
Nov. 1983	3	6.3 $\pm$ 1.5	47.7 $\pm$ 65.6	54.0 $\pm$ 67.0	3.3 $\pm$ 4.2	21.3 $\pm$ 1.5	10.7 $\pm$ 3.7	44
Dec.	5	8.6 $\pm$ 10.7	4.8 $\pm$ 6.2	13.4 $\pm$ 16.6	0.2 $\pm$ 0.4	14.8 $\pm$ 3.6	2.4 $\pm$ 5.7	10
Jan. 1984	4	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	12.8 $\pm$ 1.0	0.8 $\pm$ 5.1	43
Feb.	5	0.2 $\pm$ 0.4	0 $\pm$ 0	0.2 $\pm$ 0.4	0 $\pm$ 0	13.6 $\pm$ 1.5	5.0 $\pm$ 4.3	12
Mar.	4	1.0 $\pm$ 2.0	0 $\pm$ 0	1.0 $\pm$ 2.0	0 $\pm$ 0	17.0 $\pm$ 1.4	11.9 $\pm$ 5.5	25
Apr.	4	8.2 $\pm$ 7.5	44.5 $\pm$ 55.3	52.8 $\pm$ 55.0	3.8 $\pm$ 3.8	19.2 $\pm$ 1.0	15.1 $\pm$ 3.6	7
May	5	42.8 $\pm$ 25.9	79.4 $\pm$ 78.1	122.2 $\pm$ 80.4	0 $\pm$ 0	22.2 $\pm$ 1.3	17.7 $\pm$ 4.8	47
Jun.	2	8.0 $\pm$ 4.2	20.0 $\pm$ 14.1	28.0 $\pm$ 18.4	1.0 $\pm$ 0.0	24.0 $\pm$ 0.0	20.8 $\pm$ 2.0	25
Jul.	3	7.0 $\pm$ 2.0	13.3 $\pm$ 7.6	20.3 $\pm$ 8.1	5.3 $\pm$ 3.1	27.0 $\pm$ 1.0	23.3 $\pm$ 1.0	2
Aug.	5	5.8 $\pm$ 2.9	11.8 $\pm$ 8.3	17.6 $\pm$ 10.5	1.0 $\pm$ 1.4	27.2 $\pm$ 0.5	23.1 $\pm$ 1.0	21
Sep.	3	11.0 $\pm$ 2.0	8.0 $\pm$ 8.7	19.0 $\pm$ 10.4	2.3 $\pm$ 2.1	25.7 $\pm$ 1.5	18.3 $\pm$ 3.5	24
Oct.	3	4.0 $\pm$ 3.0	1.3 $\pm$ 1.5	5.3 $\pm$ 2.3	1.7 $\pm$ 1.5	23.3 $\pm$ 1.2	20.7 $\pm$ 2.9	159
Nov.	5	17.0 $\pm$ 11.9	14.0 $\pm$ 21.7	31.0 $\pm$ 30.0	1.4 $\pm$ 1.7	20.2 $\pm$ 3.2	13.4 $\pm$ 8.8	35
Dec.	3	11.3 $\pm$ 9.7	0.7 $\pm$ 1.2	12.0 $\pm$ 9.5	1.3 $\pm$ 1.5	17.3 $\pm$ 1.2	12.8 $\pm$ 9.7	64
Jan. 1985	5	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	14.2 $\pm$ 2.2	3.0 $\pm$ 5.9	65
Feb.	3	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	12.7 $\pm$ 2.1	9.8 $\pm$ 7.6	34
Mar.	4	3.0 $\pm$ 5.4	0 $\pm$ 0	3.0 $\pm$ 5.4	0 $\pm$ 0	17.0 $\pm$ 1.4	14.2 $\pm$ 6.3	62
Apr.	2	13.0 $\pm$ 0.0	0 $\pm$ 0	13.0 $\pm$ 0	0.5 $\pm$ 0.7	20.0 $\pm$ 0	20.0 $\pm$ 7.1	96

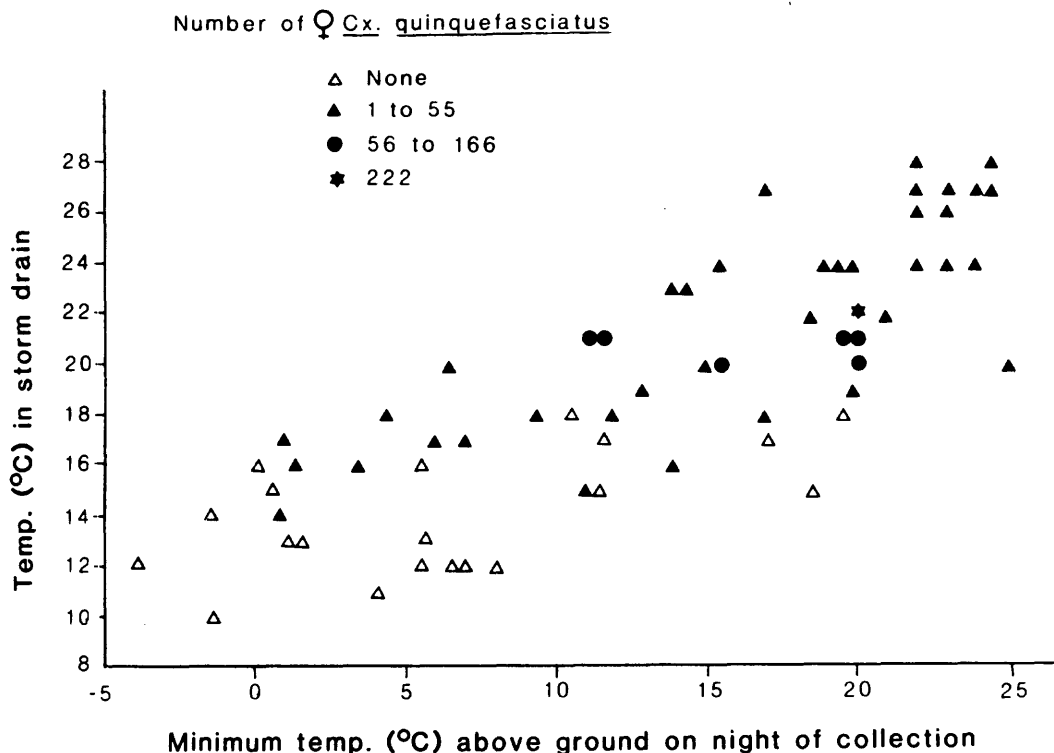


Fig. 1. Effects of temperature on activity of *Cx. quinquefasciatus*.

the storm drain frequently. Some of these larvae probably contributed to the numbers of non-gravid females and males collected in the light trap, but the presence of these categories of mosquitoes during most months of the study suggests that some males and females entered the drain from above-ground sites. Entrance into the drain was apparently greatest during the spring and fall, when cool surface temperatures may have caused mosquitoes to seek the moderate temperatures of the storm drain. Active females were not captured in this study during the coldest months of the year; however, in Houston, Texas, Hunt and Hacker (1984) captured *Cx. quinquefasciatus* in January and February in some of the storm drains they examined. Possibly, the storm drains with active mosquitoes were more sheltered than the drain in our study, but the specific qualities of such winter refuges remain to be discovered.

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